

A new shallow-water species of the genus *Galathea* (Decapoda: Anomura: Galatheididae) from the Ryukyu and Izu Islands, Japan

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Abstract.— A new galatheid, *Galathea guttata*, is described and illustrated from the Ryukyu and Izu Islands, Japan. This species resembles *G. amamiensis* Miyake & Baba, 1966, but is distinguished from that species by having no spine on the third segment of the antennal peduncle, an epipod on the second pereopod, and two rounded, pale blue or white marks on the distal part of the cheliped palm.

Introduction

Galatheid crustaceans from shallow-water down to 50 m in depth, are mainly represented in the Indo-West Pacific region by species of genera such as *Galathea* Fabricius, 1793, *Munida* Leach, 1820, *Allogalathea* Baba, 1969, *Phylladiorhynchus* Baba, 1969, *Sadayoshia* Baba, 1969, *Lauriea* Baba, 1971, and *Coralliogalathea* Baba & Javed, 1974 (Miyake & Baba, 1966; Baba & Javed, 1974; Baba, 1979, 1982, 1989; Osawa & Okuno, 2002). Among these, *Galathea* is most speciose and composed of approximately 20 species.

Recent observations and photography with SCUBA equipment show diverse shallow-water crustaceans and provide color characters of many crustacean species (e.g., Debelius, 1999; Kato & Okuno, 2001; Minemizu, 2002; Kawamoto & Okuno, 2003). The coloration is often very useful in the decapods for discrimination of cryptic or sibling species (e.g., Knowlton, 1986; Knowlton & Mills, 1992).

Kato & Okuno (2001: 87, 88) introduced two unidentified species of *Galathea*, "*Galathea* sp. A" and "*Galathea* sp. B", from

Hachijo-jima Island in the Izu Islands, Japan. Although the photographed specimen of "*Galathea* sp. A" could not be collected, it is probably referable to *G. spinosorostris* Dana, 1852, based on the possession of white marks along the opposable margins of the fingers of the cheliped, one of the recognition characters of this species (see Kawamoto & Okuno, 2003: 95, 156, unnumbered figs.). Kato & Okuno (2001: 88) pointed out that "*Galathea* sp. B" resembles *G. amamiensis* Miyake & Baba, 1966 or *G. orientalis* Stimpson, 1858 in morphology and color. The photographed specimen of "*Galathea* sp. B" was collected and placed at my disposal.

Three specimens of galatheids recently collected from shallow-waters around the Ryukyu Islands proved to be identical with Kato & Okuno's (2001) "*Galathea* sp. B". Comparison between these specimens and material of *G. amamiensis* at hand from the Ryukyu Islands disclosed that they are distinguished by the number of epipods, armature of the third segment of the antennal peduncles, and color pattern of the palm of the cheliped. This paper describes and illustrates a new species of *Galathea* based on three specimens from the Ryukyu Islands and one specimen from the Izu Islands.

The general terminology followed is that used by Baba & de Saint Laurent (1996: 435). The term "supraocular spine (tooth)" is here treated as the proximal tooth of the rostrum. The postorbital carapace length (cl), as the indication of specimen size given under "Material examined", is measured from the orbital margin to the posterior margin of the carapace in midline. The length of rostrum is measured from the tip of the ro-

trum to the orbital margin in midline. The lengths of articles of cheliped are measured along the dorsomesial margin and those of walking legs are along the extensor margin, respectively. The specimens examined are deposited in the Coastal Branch of Natural History Museum and Institute, Chiba (CMNH, with code of ZC), and National Science Museum, Tokyo (NSMT, with code of Cr).

For comparative purposes, the following specimens deposited in the above museums and the Zoological Museum, Tel-Aviv University (ZMTAU), have been examined.

Galathea amamiensis Miyake & Baba, 1966: one male, cl 2.8 mm, one female, cl 3.3 mm, Maeda, Onna, Okinawa-jima Island, Ryukyu Islands, 26 m, among branches of dead coral, 7 July 2000, coll. Y. Fujita, NSMT-Cr 15992; two males, cl 3.5, 3.7 mm, one female (parasitized by *Rhizocephala*), cl 3.3 mm, one ovigerous female, cl 3.2 mm, Chibishi, southwest off Okinawa-jima Island, Ryukyu Islands, 10–20 m, among branches of dead coral, 11 December 2001, coll. Y. Fujita, NSMT-Cr 15993; one male, cl 4.1 mm, Imazuni, Kume-jima Island, Ryukyu Islands, 18 m, 21 July 2002, coll. T. Kawamoto, CMNH-ZC 1023; one ovigerous female, cl 3.5 mm, Amitori, Iriomote-jima Island, Ryukyu Islands, 2 m, among branches of *Acropora* sp., 7 June 1997, coll. M. Mitsuhashi, NSMT-Cr 15994.

Galathea brevimana Paulson, 1875: one male (parasitized by *Rhizocephala*), cl 4.1 mm, Wadi Tal, Gulf of Suez, 1–2 m, dead coral, 21 October 1972, coll. Ch. Lewinsohn, ZMTAU AR 27133.

Taxonomy

Galathea guttata, new species

(Figs. 1–3)

Galathea sp. B: Kato & Okuno, 2001: 88, unnumbered fig.

Material examined.—Holotype: female, cl 4.3 mm, Imazuni, Kume-jima Island, Ryukyu Islands, 18 m, under rock, 26 August 2002, coll. T. Kawamoto, CMNH-ZC

1162. Paratypes: one male, cl 2.3 mm, near Sesoko Station (Tropical Biosphere Research Center, University of the Ryukyus), Okinawa-jima Island, Ryukyu Islands, 2 m, among branches of dead coral, 25 July 2001, coll. M. Osawa, NSMT-Cr 15774; one male, cl 3.3 mm, Chibishi, southwest off Okinawa-jima Island, Ryukyu Islands, 10–20 m, among branches of dead coral, 11 December 2001, coll. Y. Fujita, NSMT-Cr 17775; one ovigerous female, cl 2.5 mm, Nazumado, Hachijo-jima Island, Izu Islands, 40 m, 5 October 2000, coll. S. Kato, CMNH-ZC 1483 [photographed specimen of "*Galathea* sp. B" by Kato & Okuno (2001)].

Description.—Carapace (Fig. 1A) as long as broad or slightly broader than long (excluding rostrum and lateral spines); lateral margins slightly convex, with 6 spines on each side; first (anterolateral) spine pronounced, second to sixth spines located behind end of anterior bifurcation of cervical groove, sixth spine much smaller than others; another spine ventral to level slightly behind of anterolateral spine; dorsal surface with distinct transverse ridges anteriorly bearing dense, short plumose setae and scattered, short simple setae (not illustrated), most ridges uninterrupted, anterior first transverse ridge with pair of submedian spines (anterior gastric spines), second transverse ridge bearing spine near each lateral extremity, ridges connected to bases of second, fourth, fifth, and sixth lateral spines uninterrupted, ridge connected to base of third lateral spines interrupted or uninterrupted; cervical grooves indistinct.

Rostrum (Fig. 1A) broadly triangular, 0.5–0.6 postorbital carapace length and 1.4–1.6 times as long as broad when measured between incisions formed by 2 proximal teeth; dorsal surface with small flattened squamiform ridges and pits bearing short setae; lateral margins with 4 deeply incised teeth, proximal tooth smallest, ultimate tooth terminating opposite 0.3–0.5 length of sharply pointed, rostral median spine. Outer angles of orbits strongly produced, each terminating in spine; suborbital margins

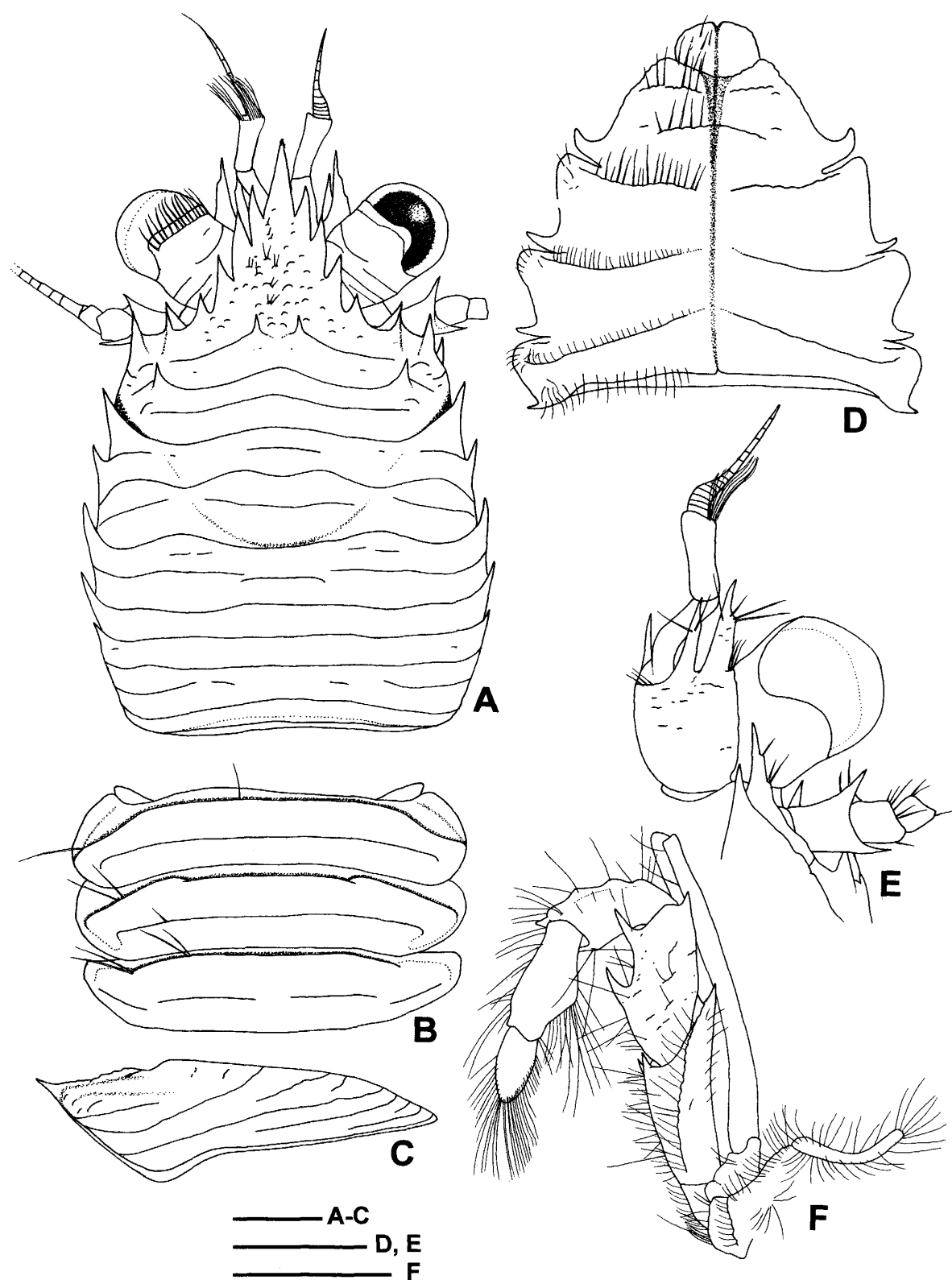


Fig. 1. *Galathea guttata*, new species, holotype female (cl 4.3 mm, CMNH-ZC 1162), Kume-jima Island, Ryukyu Islands. A, carapace and cephalic appendages, dorsal (setae omitted from right side); B, second to fourth abdominal segments, dorsal (setae omitted from right side); C, left pterygostomial flap, lateral; D, sternal plastron, ventral (setae omitted from left side); E, left eye, and antennular and antennal peduncles, ventral; F, left third maxilliped, lateral. Scales equal 1.0 mm.

unarmed.

Pterygostomial flaps (Fig. 1C) each anteriorly ending in sharply pointed spine, surface and anterior dorsal margin unarmed.

Sternal plastron (Fig. 1D) depressed along midline, with few long transverse striae on fourth sternite but no striae on fifth to seventh sternites; third sternite broader than long, roundly quadrangular or subovate, anteriorly narrowed, anterior margin with small median notch; fourth sternite (including posterior lateral projection) 2.7 times as broad as third, anterior margin strongly concave; fifth to seventh sternites smooth but bearing short setae on lateral parts.

Abdominal segments (Fig. 1B) with sparse, short and long, stiff simple setae; each segment with 2 transverse ridges anteriorly bearing dense, short plumose setae (not illustrated), no additional striae; anterior ridge somewhat elevated and uninterrupted in second, third, and fourth segments but not elevated and interrupted at median part in fifth and sixth segments; posterior ridge uninterrupted in second and third segments, interrupted at median and lateral parts in fourth segment, and interrupted at only median part in fifth and sixth segments. Telson weakly calcified, indistinctly divided by shallow sutures, and with squamiform ridges on distal 0.7; distal margin with median notch.

Eyes (Fig. 1A, E) large, slightly convex on mesial and lateral margins, with fringe of simple setae (eyelash) near distal margin of peduncle; corneas slightly dilated.

Antennular peduncles (Fig. 1A, E) with basal segment armed with 3 well developed terminal spines, mesial terminal spine smallest, dorsal spine larger than terminal lateral spine, lateral margin unarmed; ultimate and penultimate segments subequal in length; ultimate segment with 2 pronounced tufts of short, thin simple setae on dorsodistal margin mesially and laterally.

Antennal peduncles (Fig. 1A, E) with first segment armed with well developed distomesial spine reaching or nearly reaching distal margin of third segment; second seg-

ment with distomesial and distolateral spines of subequal size, reaching or nearly reaching distal margin of third segment; third and fourth segments unarmed.

Third maxilliped (Fig. 1F) with ischium slightly shorter than merus when measured on mesial margin, usually with 1 small spine (2 spines in holotype) on distoflexor margin; distoextensor margin strongly produced, terminating in small spine; dorsal mesial ridge (crista dentata) with 19–21 denticles. Merus with 2 subequal-sized spines on flexor margin, each spine situated approximately at midlength and terminal corner; extensor margin unarmed except for distal small spine. Carpus with 3 or 4 low protuberances and blunt distal spine on extensor margin, each protuberance sometimes bearing minute spinule. Propodus and dactylus unarmed. Exopod slender, distinctly overreaching distal margin of merus, with terminal flagellum.

Chelipeds (Fig. 2A, B) moderately slender, 2.4–3.1 times postorbital carapace length, generally similar in male and female, with short and long, simple stiff and plumose setae in moderate density; 4 rows of spines (1 mesial, 2 dorsal, and 1 lateral) visible in dorsal view on merus, carpus, and palm, distomesial spine of carpus largest; in palm, additional row of small spines present ventrally along lateral row of spines; in merus, carpus, and palm, ventral surface mesially with row of spines. Ischium with spine each on dorsodistal, and ventrodistal mesial and lateral margins. Merus moderately long; ventrodistal margin with strong spine each at mesial and lateral angles; ventral surface with squamiform ridges. Carpus 0.5–0.6 times as long as merus, not broadened distally; ventrodistal mesial angle produced, with small spine; ventral surface with squamiform ridges. Palm 1.1 length of carpus, 1.8–2.1 times as long as broad measured on dorsodistal margin; small spine present dorsally at base of movable finger (dactylus); ventral surface with short squamiform ridges. Fingers feebly or somewhat gaping, distally fitting to each other with

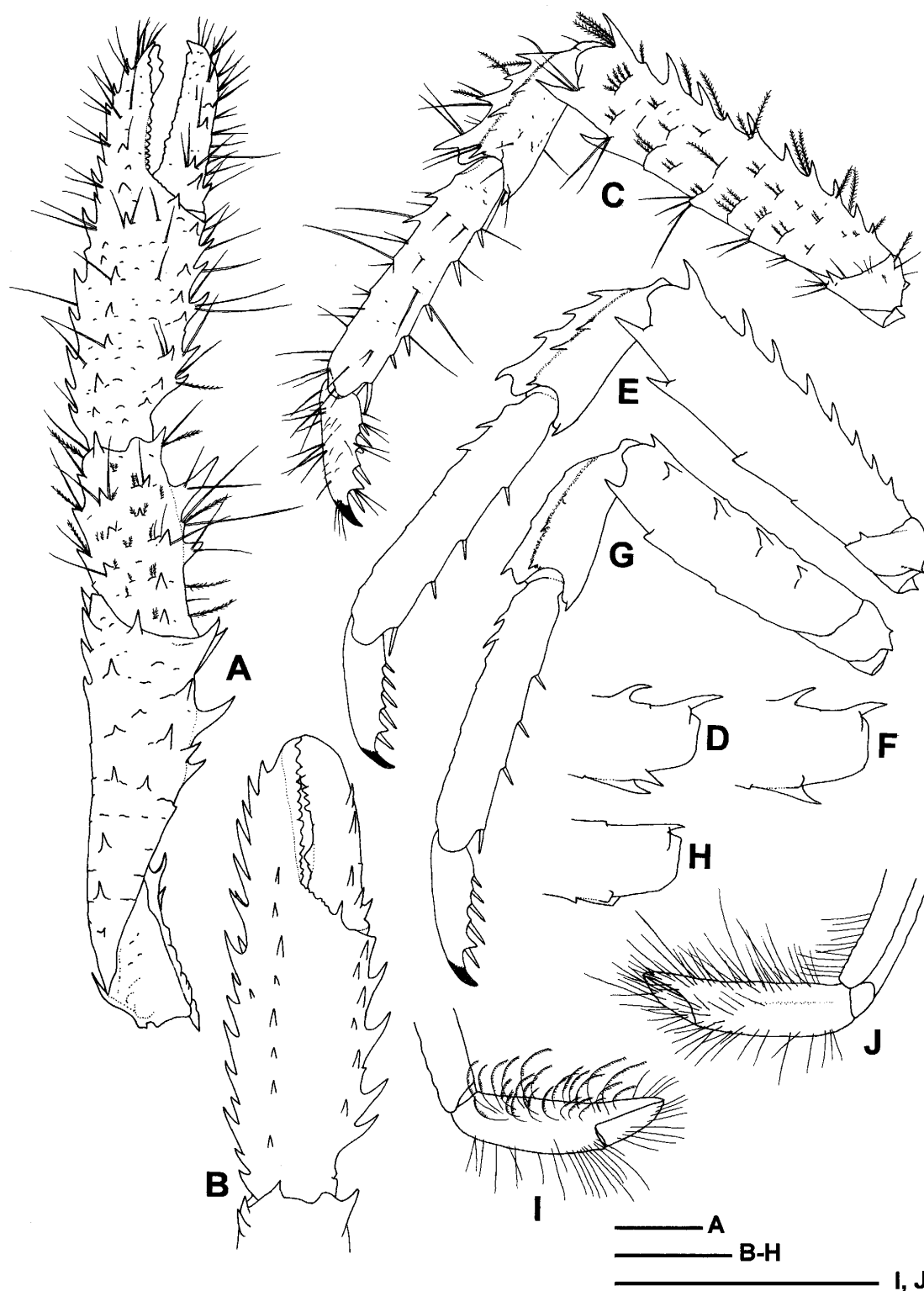


Fig. 2. *Galathea guttata*, new species, holotype female (cl 4.3 mm, CMNH-ZC 1162), Kume-jima Island, Ryukyu Islands (A, C–H); paratype male (cl 3.3mm, NSMT-Cr 15775), Chibishi, southwest off Okinawa-jima Island, Ryukyu Islands (B, I, J). A, left cheliped, dorsal (setae partially omitted); B, same, chela, dorsal (setae omitted); C, left second pereopod, lateral; D, same, distal part of merus, mesial; E, left third pereopod, lateral (setae omitted); F, same, distal part of merus, mesial; G, left fourth pereopod, lateral (setae omitted); H, same, distal part of merus, mesial; I, left fifth pereopod, chela and distal part of carpus, dorsal; J, same, ventral. Scales equal 1.0 mm.

some intermeshing, rounded teeth when closed; immovable finger with opposable margin bearing small, rounded calcareous teeth, cutting region concave; movable finger (dactylus) 0.8–0.9 times as long as palm, with 3–5 spines along proximal half of dorsomesial margin and 1 proximal spine on lateral face, opposable margin with small teeth similar to those of immovable finger, somewhat large proximal tooth occasionally present, cutting region concave.

Walking legs (second to fourth pereopods) (Fig. 2C–H) relatively robust, with short and long, plumose and simple setae; third pereopod longer than second and fourth pereopods. Ischium with lateral distal margin occasionally bearing small spine near flexor extremity on second and third pereopods but unarmed on fourth pereopod. Merus decreasing in size posteriorly, with short squamiform ridges on lateral surface; extensor margin with 8–12, 7–12, 4–6 spines on second, third, and fourth pereopods, respectively; lateral distoflexor margin with 2 spines on second and third pereopods and 1 spine on fourth pereopod; mesial distoflexor margin with 1 spine on second pereopod but unarmed or with very small tubercle on third and fourth pereopods. Carpus with extensor margin armed with 4 spines on second and third pereopods but only 1 distal spine on fourth pereopod; lateral surface with row of 2–4 (occasionally 3) spines, distal spine situated at base or rounded apex of disto-extensor projection; flexor margin terminating in small or minute spine. Propodus 1.3–1.7 length of dactylus, 3.8–5.4 times as long as high; lateral surface unarmed but with few very short or short transverse ridges on proximal part; extensor margin with 2 or 3 proximal spines; flexor margin with 5–7 slender corneous spines including distal pair, distolateral spine larger than distomesial. Dactylus ending in curved claw preceded by 4 or 5 erect teeth decreasing in size proximally, each tooth with slender corneous spine.

Fifth pereopods (Fig. 2I, J) with chela elongate, bearing numerous, moderately

long simple setae on extensor and flexor faces, setation similar in male and female; palm 2.2 times as long as dactylus, with curved, serrate setae on dorsal flexor face (in holotype, setae broken through examination); density of setae similar in male and female; carpus with moderately long, simple setae on distoflexor face.

Epipods at least present on third maxilliped, cheliped, and second pereopod; epipod on third pereopod present in largest specimen (holotype, CMNH-ZC 1162) but absent in other smaller specimens; in smallest specimen (NSMT-Cr 15774), epipod on second pereopod reduced to small bud.

Male with 2 pairs of pleopods modified as gonopods on first and second abdominal segments; pleopods on third to fifth abdominal segments flattened, spatula-shaped. Female with 4 pairs of slender, uniramous pleopods on second to fifth abdominal segments.

Uropods with protopods each armed with distomesial spine. Endopod broader than exopod, with row of spinules on lateral margin, distolateral spines distinctly larger than lateral spinules, overreaching distal margin of telson; ventral surface with longitudinal row of squamiform ridges bearing 2 or 3 small spines. Exopod with spinules on lateral margin.

Color in fresh specimens (Fig. 3A, B).—Ground color of carapace, pterygostomial flaps, abdominal segments, ocular peduncles, and pereopods orange or greenish brown. Lateral teeth of rostrum dark orange distally. Transverse ridges on carapace and abdominal segments dark orange; those of carapace with continuous blue marks along anterior margins. Cardiac and branchial regions with oblique, pale blue marks. Pterygostomial flaps each with irregular-shaped, longitudinal white mark. Abdominal segments with 6 rounded, pale blue marks on each anterior transverse ridge. Palm of cheliped dark orange on distal 0.3–0.5, with 2 rounded, pale blue or white marks on distal part; fingers also sometimes dark orange. Walking legs with pale blue or white bands

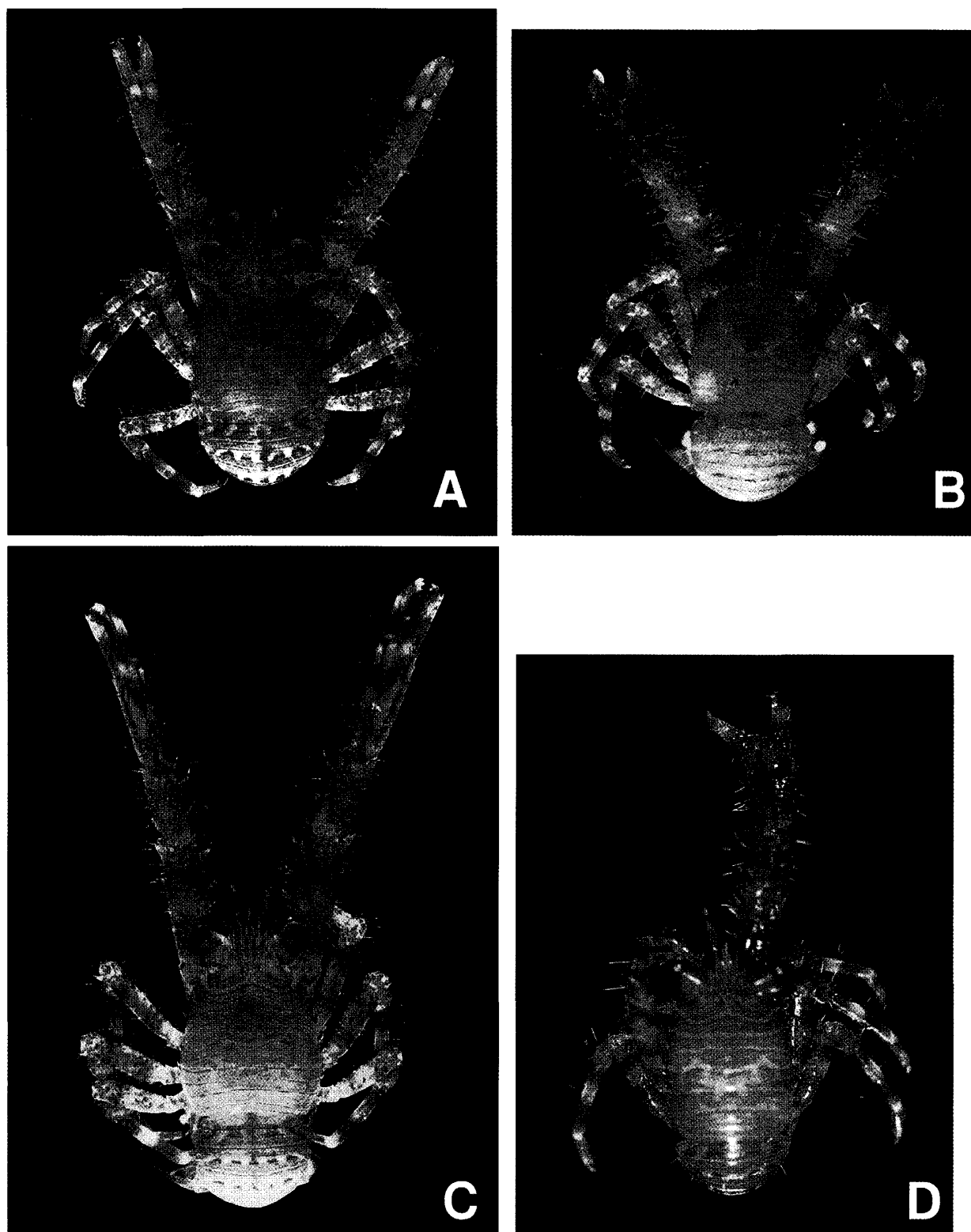


Fig. 3. Fresh specimens, dorsal view. *Galathea guttata*, new species. A, holotype female (cl 4.3 mm, CMNH-ZC 1162), Kume-jima Island, Ryukyu Islands; B, paratype ovigerous female (cl 2.5 mm, CMNH-ZC 1483, right first walking leg missing), Hachijo-jima Island, Izu Islands. *Galathea amamiensis* Miyake & Baba, 1966. C, male (cl 4.1 mm, CMNH-ZC 1023), Kume-jima Island, Ryukyu Islands; D, male (cl 2.8 mm, NSMT-Cr 15992, left cheliped missing), Okinawa-jima Island, Ryukyu Islands. Photographed by J. Okuno (A–C) and M. Osawa (D).

on median parts of merus and propodus. Simple setae on abdominal segments, chelipeds and walking legs iridescent, those on chelipeds and walking legs occasionally reddish at proximal parts.

Habitat.—The new species lives among branches of dead coral or under rock, at depths of 2–40 m. At the collection sites of the Ryukyu Islands, this species occurred with the galatheids as follows: *Galathea aegyptiaca* Paulson, 1875, *G. amamiensis*, *G. bimaculata* Miyake & Baba, 1966, *G. platycheles* Miyake, 1953, *G. spinosorostris*, *Phylladorhynchus integrorostris* (Dana, 1852), and *Sadayoshia edwardsii* (Miers, 1884).

Distribution.—So far known only from Ryukyu (Kume-jima Island and Okinawa-jima Island) and Izu (Hachijo-jima Island) Islands, Japan.

Etymology.—From the Latin, *guttatus*, meaning spotted, in reference to the two rounded marks on the palm of the cheliped of the new species.

Remarks.—*Galathea guttata* is close to *G. amamiensis*, known from the Ryukyu Islands, Moluccas, and Madagascar, in both morphology and general fresh coloration. These two species share the following morphological characters: carapace and rostrum with no pronounced plumose setae on the dorsal surface; a pair of gastric spines present; anterior second transverse ridge with a spine near each lateral extremity; no spine between the anterolateral spine and end of the anterior bifurcation of the cervical groove; rostrum with four lateral teeth; pterygostomial flap with no spine on the anterior surface; antennular peduncle with three well developed terminal spines on the basal article and with pronounced tufts of setae on the distal article; and epipod present on the first pereopod (cheliped). However, careful examination of the type material of *G. guttata* and specimens of *G. amamiensis* from the Ryukyu Islands (see Introduction) revealed that the new species is distinguished from *G. amamiensis* by having no spine on the third article of the antennal peduncles and an epipod on the second

pereopod (first walking leg). *Galathea amamiensis* has a very small distomesial spine on the third article of the antennal peduncle, which is sometimes barely discernible, and no epipod on the second pereopod.

As mentioned above, the fresh coloration of *G. guttata* also resembles that of *G. amamiensis*, especially in the transverse ridges on the carapace with continuous blue marks along the anterior margins, but differs in the possession of two rounded, pale blue or white marks on the distal part of the palm of the cheliped. In *G. amamiensis*, the cheliped palm is mottled brown and pale blue or white (see Kamezaki *et al.*, 1988: 96, unnumbered fig.; Kawamoto & Okuno, 2003: 94, unnumbered fig.; Fig. 3C, D). In addition, the rostrum and ocular peduncles are orange or greenish brown in *G. guttata*, whereas they are occasionally pink or reddish in *G. amamiensis* (see Kamezaki *et al.*, 1988: 96, unnumbered fig.; Fig. 3D).

The possession of an epipod on the second pereopod, and the carapace with distinct transverse ridges on the gastric region and the anterior first ridge with a pair of submedian spines (anterior gastric spines), are shared by *G. guttata* and *G. australiensis* Stimpson, 1858, known from the temperate Australian water and the Indian Ocean (see Lewinsohn, 1967:180, fig. 2; Haig, 1973: 277; Tirmizi & Javed, 1993: 55, fig. 24A). However, *G. guttata* is readily distinguished from *G. australiensis* by the carapace bearing a spine near each lateral extremity of the anterior second transverse ridge and six spines on each lateral margin, the second and third abdominal segments each bearing two transverse ridges, and third article of the antennal peduncle lacking spines. *Galathea australiensis* has no spines on the anterior second transverse ridge and eight spines on each lateral margin of the carapace, three or four transverse ridges on the second and third abdominal segments (posterior ridge may be interrupted), and a small spine on the distomesial margin of the third antennal article (see Lewinsohn, 1967: figs.

2, 5, 9; Tirmizi & Javed, 1993: fig. 24A, E).

Tirmizi & Javed (1993: 53) recorded *Galathea brevimana* Paul'son, 1875 from the Indian Ocean and described it as having epipods on the first to third pereopods, and distinct transverse ridges on the gastric region and a pair of submedian spines on the anterior first ridge of the carapace, as in *G. guttata* and *G. australiensis*. However, Paul'son (1875: 101) and Lewinsohn (1969: 105) did not mention on the number of epipods of the Red Sea specimens of *G. brevimana*. Tirmizi & Javed's material differs from the Red Sea specimens in having no spine between the anterolateral spine of the carapace and the end of the anterior bifurcation of the cervical groove. This character is possessed by *G. guttata*, but the Indian Ocean specimens are distinctive in having much smaller, proximal two lateral teeth of the rostrum and anterior gastric spines, and no spine near the lateral extremity of the anterior second transverse ridge of the carapace (see Tirmizi & Javed, 1993: fig. 23A). Thus, Tirmizi & Javed's (1993) specimens are not clearly conspecific with those of Paul'son (1875) and Lewinsohn (1969) of *G. brevimana* and may be assigned to an undescribed species. Lewinsohn (1969: 11) indicated that his material was deposited separately in the Nationaal Natuurhistorisch Museum, Leiden and the Zoological Museum, Tel-Aviv University. However, the specimens of *G. brevimana* examined by him were not found there (C.H.J.M. Fransen and B. Galil, personal communications). Fortunately, another specimen identified as *G. brevimana* by Lewinsohn (see Introduction) was found in the Zoological Museum, Tel-Aviv University, and made available for study. Examination of this specimen revealed that it generally agrees with the account of Lewinsohn (1969: 105) and the epipods are present on the first pereopods (chelipeds) but not on the second and third pereopods. However, it remains uncertain whether the specimens of Paul'son (1875) and Lewinsohn (1969) of *G. brevimana* are conspecific, because the number of spines

on the branchial margin of the carapace is different between the descriptions of the two authors: five spines in the Paul'son's sole specimen, six spines in the Lewinsohn's material including the specimen examined here. If the possession of an epipod only on the first pereopod is one of characters of *G. brevimana*, the number of epipods clearly distinguishes this species from *G. guttata* and *G. australiensis*. Both of these species have epipods at least on the first and second pereopods.

Acknowledgements

I am indebted to S. Kato of "Regulus Diving" in Hachijo-jima Island and T. Kawamoto of "Dive Estivant" in Kume-jima Island, and Y. Fujita of the University of the Ryukyus, for collecting the specimens of the new species, and J. Okuno of the Coastal Branch of Natural History Museum and Institute, Chiba, for allowing me to publish the color photographs taken by him. The material examined by Lewinsohn (1969) was kindly located by B. Galil of the National Institute of Oceanography, Israel, A. Shagman of the Zoological Museum, Tel-Aviv University, and C. H. J. M. Fransen of the Nationaal Natuurhistorisch Museum, Leiden. I also thank R. Lemaitre of the National Museum of Natural History, Smithsonian Institution, for reading a draft of this paper. K. Baba of Kumamoto University is gratefully acknowledged for constructive comments to improve the manuscript. This study was supported in part by a Research Fellowship for Young Scientists from the Japan Society for the Promotion of Science and a Grant from the Research Institute of Marine Invertebrates.

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